

SEQUENCE LISTING

<110> Kabushiki Kaisha Hayashibara Seibutsu Kagaku Kenkyujo

<120> Cyclic maltosylmaltose, cyclic maltosylmaltose-forming enzyme, their preparation and uses

<130> 10102802

<160> 10

<210> 1

<211> 5

<212> PRT

<213> Arthrobacter globiformis

<400> 1

Asp Pro Thr Thr Ser

1

5

<210> 2

<211> 583

<212> PRT

<213> Arthrobacter globiformis

<400> 2

Asp Pro Thr Thr Ser Pro Gly Pro Leu Ala Glu Gly Asp Val Ile Tyr

1

5

10

15

Gln Val Leu Val Asp Arg Phe Glu Asp Gly Asp Pro Thr Asn Asn Asp

20

25

30

Gln Gly Asp Gly Glu Tyr Asp Pro Ser Asp Leu Gly Phe Tyr His Gly

35

40

45

Gly Asp Trp Ala Gly Leu Thr Asp Arg Leu Asp Tyr Ile Ala Asp Leu

50

55

60

Gly Val Thr Ala Ile Trp Leu Ser Pro Val Ser Glu Gln Gln Pro Leu

65		70		75		80									
Ser	Arg	Asp	Gly	Leu	Glu	Ala	Ser	Tyr	His	Gly	Tyr	Phe	Thr	Arg	Asp
		85						90						95	
Phe	Ala	Thr	Pro	Asn	Glu	His	Phe	Gly	Asp	Arg	Ala	Glu	Leu	Gln	Glu
		100						105					110		
Leu	Ile	Asp	Thr	Ala	His	Asp	Leu	Gly	Leu	Lys	Met	Ile	Leu	Asp	Val
		115						120					125		
Val	Pro	Asn	His	Thr	Ala	Asp	Tyr	Leu	Ala	Gly	Thr	Ser	Thr	Thr	Tyr
		130						135					140		
Ser	Pro	Ser	Thr	Tyr	Lys	Pro	Ala	Ser	Pro	Leu	Asp	Asp	Ala	Ser	Tyr
		145						150					155		160
Phe	His	His	Ala	Gly	Asp	Cys	Leu	Phe	Asn	Gly	Leu	Glu	Thr	Gln	Thr
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Gln	Ile	Glu	Asn	Cys	Asp	Leu	Gly	Gly	Leu	Asp	Asp	Leu	Asp	Gln	Ser
			180						185					190	
Asn	Pro	Val	Val	Ser	Ser	His	Leu	Met	Ser	Thr	Tyr	Lys	Asp	Trp	Val
		195						200					205		
Asp	Met	Gly	Phe	Asp	Gly	Ile	Arg	Val	Asp	Ala	Ala	Arg	Ser	Val	Pro
		210						215					220		
Lys	Pro	Trp	Leu	Ala	Asp	Phe	Glu	Ala	Glu	Met	Gly	Val	Pro	Thr	Phe
		225						230					235		240
Gly	Glu	Val	Phe	Val	Gly	Asp	Val	Asp	Tyr	Val	Ser	Glu	Tyr	Gln	Asp
				245					250					255	
Tyr	Glu	Trp	Gly	Val	Leu	Asp	Phe	Pro	Tyr	Phe	Phe	Thr	Val	Arg	Glu
			260						265					270	
Ala	Phe	Ser	Ala	Asp	Thr	Asp	Met	Asn	Lys	Leu	Gly	Asp	Leu	Phe	Asp
		275							280					285	
Gln	Asp	Ser	Lys	Tyr	Ala	Asn	Pro	Asn	Arg	Leu	Glu	Thr	Phe	Leu	Asp
		290							295				300		
Asn	His	Asp	Arg	Ala	Arg	Phe	Leu	Thr	Trp	Ala	Asp	Asp	Asn	Tyr	Gln
		305							310				315		320
Arg	Leu	Arg	Ser	Gly	Leu	Thr	Phe	Leu	Leu	Thr	Ser	Arg	Gly	Val	Pro
				325					330					335	
Val	Ile	Tyr	Tyr	Gly	Thr	Glu	Gln	Ala	Asp	Asp	Gly	Asn	Gly	Asn	Pro
			340						345					350	

Tyr Glu Val Pro Ile Ala Asn Lys Asp Asn Arg Lys Asp Met Glu Ser  
 355 360 365  
 Phe Asp Gln Asn Ser Asn Leu Tyr Lys His Ile Gln Arg Leu Thr Ala  
 370 375 380  
 Ile Lys Ala Ala Tyr Pro Ala Leu Gln Val Gly Thr Gln Arg Glu Met  
 385 390 395 400  
 Trp Ser Asp Thr Ser Val Tyr Gly Phe Ser Arg Arg Val Asp Ser Thr  
 405 410 415  
 Gly Ala Glu Ala Met Thr Phe Ser Ser Asn Ser Trp Thr Thr Gln Thr  
 420 425 430  
 Arg Thr Val Pro Leu Arg Ala Glu Ser Ser Ile Thr Val Gly Thr Thr  
 435 440 445  
 Leu Thr Asn Leu Met Asn Thr Gly Asp Thr Val Thr Val Thr Ala Gly  
 450 455 460  
 Gly Val Thr Gly Lys Gln Ile Thr Val Ser Leu Gly Glu His Glu Ser  
 465 470 475 480  
 Lys Val Tyr Ala Pro Gly Thr Pro Val Ser Ala Tyr Ser Pro Glu Ala  
 485 490 495  
 Arg Asn Thr Thr Lys Ile Arg Val His Tyr Asn Val Gly Leu Gly His  
 500 505 510  
 Ser Ile Ala Ile Arg Gly Asp Glu Tyr Pro Phe Thr Trp Thr Ser Gly  
 515 520 525  
 Arg Gly Ala Arg Asn Val Ala Ser Asp Val Trp Glu Phe Glu Val Glu  
 530 535 540  
 Arg Ile Pro Asp Gly Glu Thr Phe Gln Phe Lys Pro Leu Ile Asp Asp  
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 Val Thr Trp Ser Thr Gly Gly Asn Phe Thr Gly Thr Gly Gly Asp Val  
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 Ile Asp Ile Tyr Pro Thr Phe  
 580 583

&lt;210&gt; 3

&lt;211&gt; 1749

&lt;212&gt; DNA

<213> *Arthrobacter globiformis*

&lt;400&gt; 3

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aacgagcatt tcggcgaccg agccgagctg caggagctga tcgacacggc gcacgatctc	360
ggactcaaga tgatcctcga cgtcgtgccg aaccacacgg ccgactacct cgcgggcaca	420
tcgacgacct attcgccgag cacttacaag ccggcgagtc cgctcgatga cgcgtcgtac	480
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&lt;210&gt; 4

&lt;211&gt; 9

<212> PRT

<213> *Arthrobacter globiformis*

<400> 4

His Ile Gln Arg Leu Thr Ala Ile Lys

1

5

<210> 5

<211> 13

<212> PRT

<213> *Arthrobacter globiformis*

<400> 5

Asp Met Glu Ser Phe Asp Gln Asn Ser Asn Leu Tyr Lys

1

5

10

<210> 6

<211> 10

<212> PRT

<213> *Arthrobacter globiformis*

<400> 6

Leu Gly Asp Leu Phe Asp Gln Asp Ser Lys

1

5

10

<210> 7

<211> 27

<212> PRT

<213> *Arthrobacter globiformis*

<400> 7

Met Ile Leu Asp Val Val Pro Asn His Thr Ala Asp Tyr Leu Ala Gly

1

5

10

15

Thr Ser Thr Thr Tyr Ser Pro Ser Thr Tyr Lys

20

25

&lt;210&gt; 8

&lt;211&gt; 20

&lt;212&gt; PRT

<213> *Arthrobacter globiformis*

&lt;400&gt; 8

Asp Trp Val Asp Met Gly Phe Asp Gly Ile Arg Val Asp Ala Ala Arg

1

5

10

15

Ser Val Pro Lys

20

&lt;210&gt; 9

&lt;211&gt; 30

&lt;212&gt; PRT

<213> *Arthrobacter globiformis*

&lt;400&gt; 9

Tyr Ala Asn Pro Asn Arg Leu Glu Thr Phe Leu Asp Asn His Asp Arg

1

5

10

15

Ala Arg Phe Leu Thr Trp Ala Asp Asp Asn Tyr Gln Arg Leu

20

25

30

&lt;210&gt; 10

&lt;211&gt; 4467

&lt;212&gt; DNA

<213> *Arthrobacter globiformis*

&lt;400&gt; 10

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gtcgatctcg cgcagacgac ggaggagaaa cggtcgcagc gggaggcgct cgggctcgct	180
gtcgtcgagc agaacgtct cgtcgccgat cctcggcgag ctgctcggac cgcacgagcc	240
cacctgccc caggaccgtt catcgtgcac ctggacgtcg atgtgctgga cticctcgac	300
gcaccccttg ccgagaacgt gaacggccga aacagcgggc cgaccgtcga gcagctgcgg	360

gtcgacatcg ccgagcttct gcagcatccg gactgctggg cgatgtccat cggccagggtg 420  
gtccccgcgc acgcggcggc cgacccgacc tccatcccgc ggctcatcgg cggccctggcc 480  
gtgagctcca cgtagccgga cgtcgctcct ggagcggagc cgtcccgga ggaacggcgt 540  
cgcaccccggt cgagcggggg cgtcgccctc ttcgacgggg tctgcggcgc ggctaccgc 600  
gcggcagcgt gagccgccac cgaccagatc tcatgcatit ggacgaactt cgccgtccaa 660  
ttctctccgc gccicaagca ggtatacatc gctcgaacgc gtcttactg gcctgacggt 720  
ccgcgatcac gtctgtcagt gaagcatcct gccgcgaagg gtcttgatgc gcatgcagta 780  
cgggagtcga atcactttca cgggcacggc cgggtgcagt acttgacaaa acgcatttat 840  
acatgttgca tcatccagt aaaccgtgca gctcgcgac cgatgcgcat ccgacaacga 900  
agtcaggaga gatic atg aga acg aca gtt cgt acc gct cgc gtc tcc gcg 951

Met Arg Thr Thr Val Arg Thr Ala Arg Val Ser Ala

1

5

10

cgt acg ggc ctc gcg atg gga gca gcc gtc gcg ctg gcg gcc ggc gcg 999  
Arg Thr Gly Leu Ala Met Gly Ala Ala Val Ala Leu Ala Ala Gly Ala  
15 20 25

ctc acc tgg ggc acc ggc ccc gca ccc gcg agt gcc gac ccc acc acg 1047  
Leu Thr Trp Gly Thr Gly Pro Ala Pro Ala Ser Ala Asp Pro Thr Thr  
30 35 40

tcg ccc ggc ccg ctg gcc gag ggc gac gtg atc tac cag gtg ctc gtc 1095  
Ser Pro Gly Pro Leu Ala Glu Gly Asp Val Ile Tyr Gln Val Leu Val  
45 50 55 60

gac cgg ttc gaa gac ggc gac ccc acc aac aac gac cag ggc gac gga 1143  
Asp Arg Phe Glu Asp Gly Asp Pro Thr Asn Asn Asp Gln Gly Asp Gly  
65 70 75

gag tac gat ccg tcc gac ctc ggt ttc tac cac ggc ggc gac tgg gcg 1191  
Glu Tyr Asp Pro Ser Asp Leu Gly Phe Tyr His Gly Gly Asp Trp Ala  
80 85 90

ggc ctg acg gac cgg ctc gac tac atc gcc gat ctg ggt gtg acg gcg 1239  
Gly Leu Thr Asp Arg Leu Asp Tyr Ile Ala Asp Leu Gly Val Thr Ala

95	100	105	
atc tgg ctc tcg ccc gtc tcc gag cag cag ccg ctc tcg cgc gac ggg			1287
Ile Trp Leu Ser Pro Val Ser Glu Gln Gln Pro Leu Ser Arg Asp Gly			
110	115	120	
ctg gag gcc agc tac cac ggc tac ttc act cgg gac ttc gcg acg ccg			1335
Leu Glu Ala Ser Tyr His Gly Tyr Phe Thr Arg Asp Phe Ala Thr Pro			
125	130	135	140
aac gag cat ttc ggc gac cga gcc gag ctg cag gag ctg atc gac acg			1383
Asn Glu His Phe Gly Asp Arg Ala Glu Leu Gln Glu Leu Ile Asp Thr			
	145	150	155
gcg cac gat ctc gga ctc aag atg atc ctc gac gtc gtg ccg aac cac			1431
Ala His Asp Leu Gly Leu Lys Met Ile Leu Asp Val Val Pro Asn His			
	160	165	170
acg gcc gac tac ctc gcg ggc aca tcg acg acc tat tcg ccg agc acc			1479
Thr Ala Asp Tyr Leu Ala Gly Thr Ser Thr Thr Tyr Ser Pro Ser Thr			
	175	180	185
tac aag ccg gcg agt ccg ctc gat gac gcg tcg tac ttc cat cac gcc			1527
Tyr Lys Pro Ala Ser Pro Leu Asp Asp Ala Ser Tyr Phe His His Ala			
190	195	200	
ggc gac tgc ctg ttc aac ggg ctc gag acg cag acc cag atc gag aac			1575
Gly Asp Cys Leu Phe Asn Gly Leu Glu Thr Gln Thr Gln Ile Glu Asn			
205	210	215	220
tgc gac ctc ggc ggg ctc gac gac ctc gat cag tcg aac ccg gtc gtc			1623
Cys Asp Leu Gly Gly Leu Asp Asp Leu Asp Gln Ser Asn Pro Val Val			
	225	230	235
tcg tcg cac ctg atg agc acg tac aag gac tgg gtc gac atg ggc ttc			1671



Ser Ser His Leu Met Ser Thr Tyr Lys Asp Trp Val Asp Met Gly Phe	
240 245 250	
gac ggc atc cgg gtc gat gcg gcg cgc tcg gtg ccg aag ccg tgg ctc	1719
Asp Gly Ile Arg Val Asp Ala Ala Arg Ser Val Pro Lys Pro Trp Leu	
255 260 265	
gcc gac ttc gaa gcc gag atg ggc gtg ccg acc ttc ggc gag gtg ttc	1767
Ala Asp Phe Glu Ala Glu Met Gly Val Pro Thr Phe Gly Glu Val Phe	
270 275 280	
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Val Gly Asp Val Asp Tyr Val Ser Glu Tyr Gln Asp Tyr Glu Trp Gly	
285 290 295 300	
gtg ctc gac ttc ccc tac ttc ttc acg gtg cgc gag gcg ttc tcg gcc	1863
Val Leu Asp Phe Pro Tyr Phe Phe Thr Val Arg Glu Ala Phe Ser Ala	
305 310 315	
gat acc gac atg aac aag ctc ggc gac ctc ttc gac cag gac agc aag	1911
Asp Thr Asp Met Asn Lys Leu Gly Asp Leu Phe Asp Gln Asp Ser Lys	
320 325 330	
tac gcg aac ccg aac cgg ctg gag acg ttc ctc gac aac cac gat cgg	1959
Tyr Ala Asn Pro Asn Arg Leu Glu Thr Phe Leu Asp Asn His Asp Arg	
335 340 345	
gcg cgg ttc ctc acc tgg gcc gat gac aac tat cag cgg ctg cgc tca	2007
Ala Arg Phe Leu Thr Trp Ala Asp Asp Asn Tyr Gln Arg Leu Arg Ser	
350 355 360	
gga ctg acg ttc ctc cta acc tcc cgg ggc gtg ccc gtg atc tac tac	2055
Gly Leu Thr Phe Leu Leu Thr Ser Arg Gly Val Pro Val Ile Tyr Tyr	
365 370 375 380	

ggc acc gag cag gcc gac gac ggc aac ggc aac ccc tac gag gta ccg	2103
Gly Thr Glu Gln Ala Asp Asp Gly Asn Gly Asn Pro Tyr Glu Val Pro	
385 390 395	
atc gcg aac aag gac aac cgc aag gac atg gag agc ttc gat cag aac	2151
Ile Ala Asn Lys Asp Asn Arg Lys Asp Met Glu Ser Phe Asp Gln Asn	
400 405 410	
tcg aac ctc tac aag cac atc cag cgg ttg acc gcg atc aag gcc gct	2199
Ser Asn Leu Tyr Lys His Ile Gln Arg Leu Thr Ala Ile Lys Ala Ala	
415 420 425	
tac ccg gct ctg cag gtc ggc aca cag cgc gag atg tgg tcc gac acc	2247
Tyr Pro Ala Leu Gln Val Gly Thr Gln Arg Glu Met Trp Ser Asp Thr	
430 435 440	
tcc gtc tac ggg ttc tcg cga cgc gtc gac agc acg ggt gcc gag gcg	2295
Ser Val Tyr Gly Phe Ser Arg Arg Val Asp Ser Thr Gly Ala Glu Ala	
445 450 455 460	
atg acc ttc tcg tcg aac tcg tgg acg acg cag acg cgc acg gtg ccg	2343
Met Thr Phe Ser Ser Asn Ser Trp Thr Thr Gln Thr Arg Thr Val Pro	
465 470 475	
ctg cgc gcc gag agc tcg atc acg gtc ggt acg acg ctg acg aac ctc	2391
Leu Arg Ala Glu Ser Ser Ile Thr Val Gly Thr Thr Leu Thr Asn Leu	
480 485 490	
atg aac acg ggc gac acg gtg acc gtg acc gcc ggc ggt gtc acg ggg	2439
Met Asn Thr Gly Asp Thr Val Thr Val Thr Ala Gly Gly Val Thr Gly	
495 500 505	
aag cag atc acc gtc tcc ctc ggc gag cac gag agc aag gtc tat gcg	2487
Lys Gln Ile Thr Val Ser Leu Gly Glu His Glu Ser Lys Val Tyr Ala	
510 515 520	

ccc ggc acc ccg gta tcg gca tac agc ccc gaa gcg cgc aac acc acg	2535
Pro Gly Thr Pro Val Ser Ala Tyr Ser Pro Glu Ala Arg Asn Thr Thr	
525                      530                      535                      540	
aag atc cgc gtg cac tac aac gtg ggc ctc ggg cac agc atc gcg atc	2583
Lys Ile Arg Val His Tyr Asn Val Gly Leu Gly His Ser Ile Ala Ile	
545                      550                      555	
cgc ggc gac gag tac ccg ttc acc tgg acc tcc ggc cga ggc gcg cgc	2631
Arg Gly Asp Glu Tyr Pro Phe Thr Trp Thr Ser Gly Arg Gly Ala Arg	
560                      565                      570	
aac gtc gcg tcc gac gtc tgg gag ttc gag gtc gag cgc atc ccc gac	2679
Asn Val Ala Ser Asp Val Trp Glu Phe Glu Val Glu Arg Ile Pro Asp	
575                      580                      585	
ggt gag acc ttc cag ttc aag cct ctg atc gac gac gtc acc tgg tcg	2727
Gly Glu Thr Phe Gln Phe Lys Pro Leu Ile Asp Asp Val Thr Trp Ser	
590                      595                      600	
acc ggc ggc aac ttc acc ggg acg ggc ggc gac gtg atc gac atc tac	2775
Thr Gly Gly Asn Phe Thr Gly Thr Gly Gly Asp Val Ile Asp Ile Tyr	
605                      610                      615                      620	
ccc acc ttc tga acccatccct cccgggactc caccgaaagg atgcttgtga gccac	2832
Pro Thr Phe	
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